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COST ESTIMATING IN DoD: Current Status, Trends, and What the Future Holds

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June 2005
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Topics

- ❖ **Current Status:** Baseline analysis of the current cost estimating community, including which organizations are responsible for developing and reviewing cost estimates, how many personnel there are, what their longevity in the profession is, and what their current professional skillsets are.
- ❖ **Trends**
- ❖ **The Future**

PURPOSES OF EFFORT FOR DEPARTMENTS OF ARMY AND NAVY

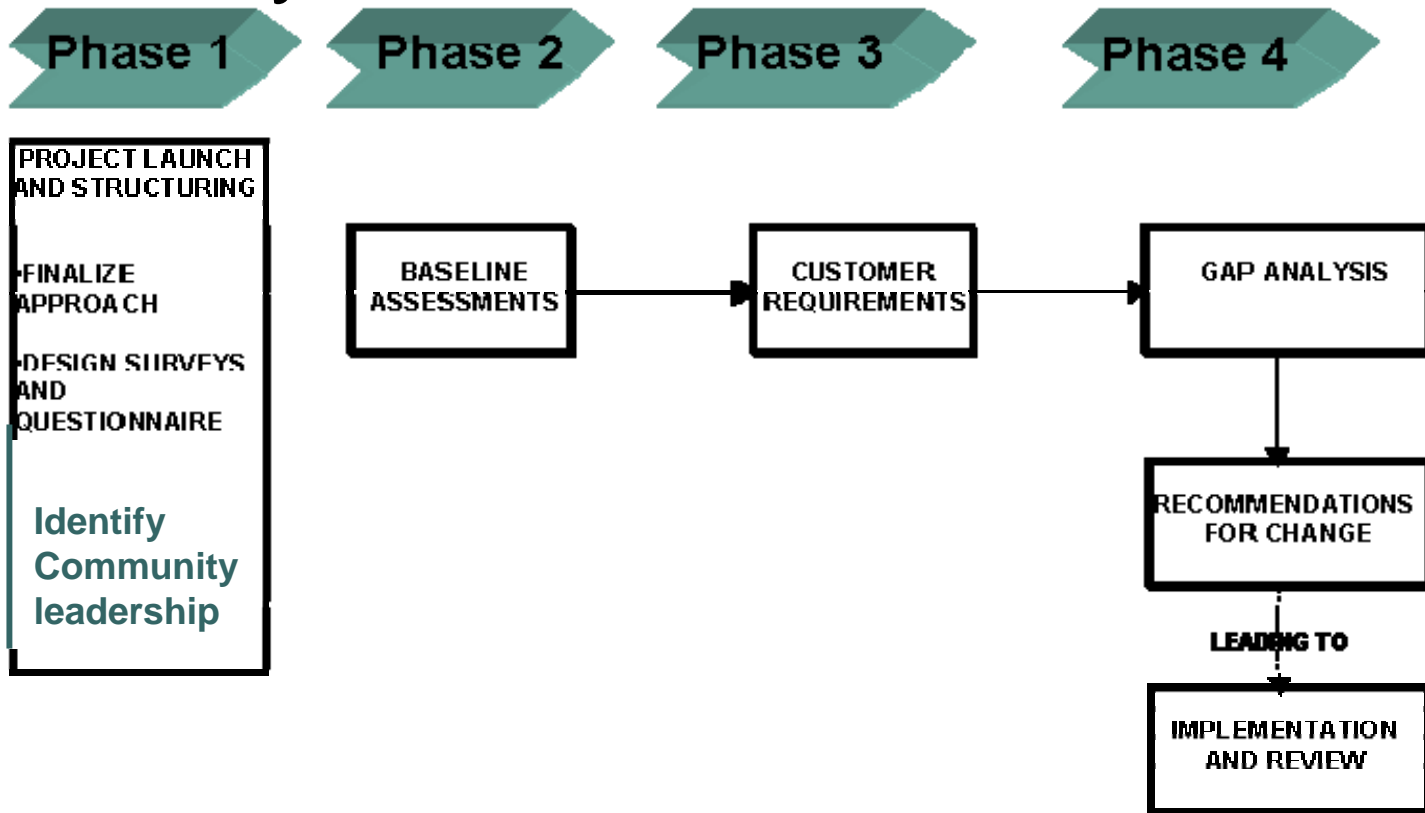
- Overarching purpose is to identify areas for improvements in cost estimating, analysis and management community to ensure high quality, responsive, and customer-focused support at all levels in the departments.
 - Develop baseline assessment of Army's and Navy's cost estimating, analysis and management communities
 - Evaluate the extent to which the cost estimating and analysis community is meeting Army and Navy leadership's current and projected needs
 - Evaluate the extent to which the cost management community is meeting Army leadership's current and projected needs
 - Support DASA-CE's mission to "***Provide the Army decision-makers with cost, performance and economic analysis in the form of expertise, models, data, estimates and analyses at all levels.***"
 - Support NCAD's mission to "***guide, direct, and strengthen cost analysis in the DoN***"
 - Produce specific recommendations for improvements.

Scope

- **PEOPLE.** What is the size, location, and experience of the government in-house cost estimating and analysis workforce?
- **PROCESS:** What analyses are done, at whose request, how are the results transmitted, and who else receives the results? What processes exist for the execution of cost research, recruiting, training, knowledge sharing and QA, including accountability for timeliness and reliability?
- **TECHNOLOGY:** What data, estimating tools, research and IT infrastructure are available to support the cost estimating and analysis workforce?

The study compares the current status of people, processes, and technologies to those that are needed to meet the challenges in the 21st century.

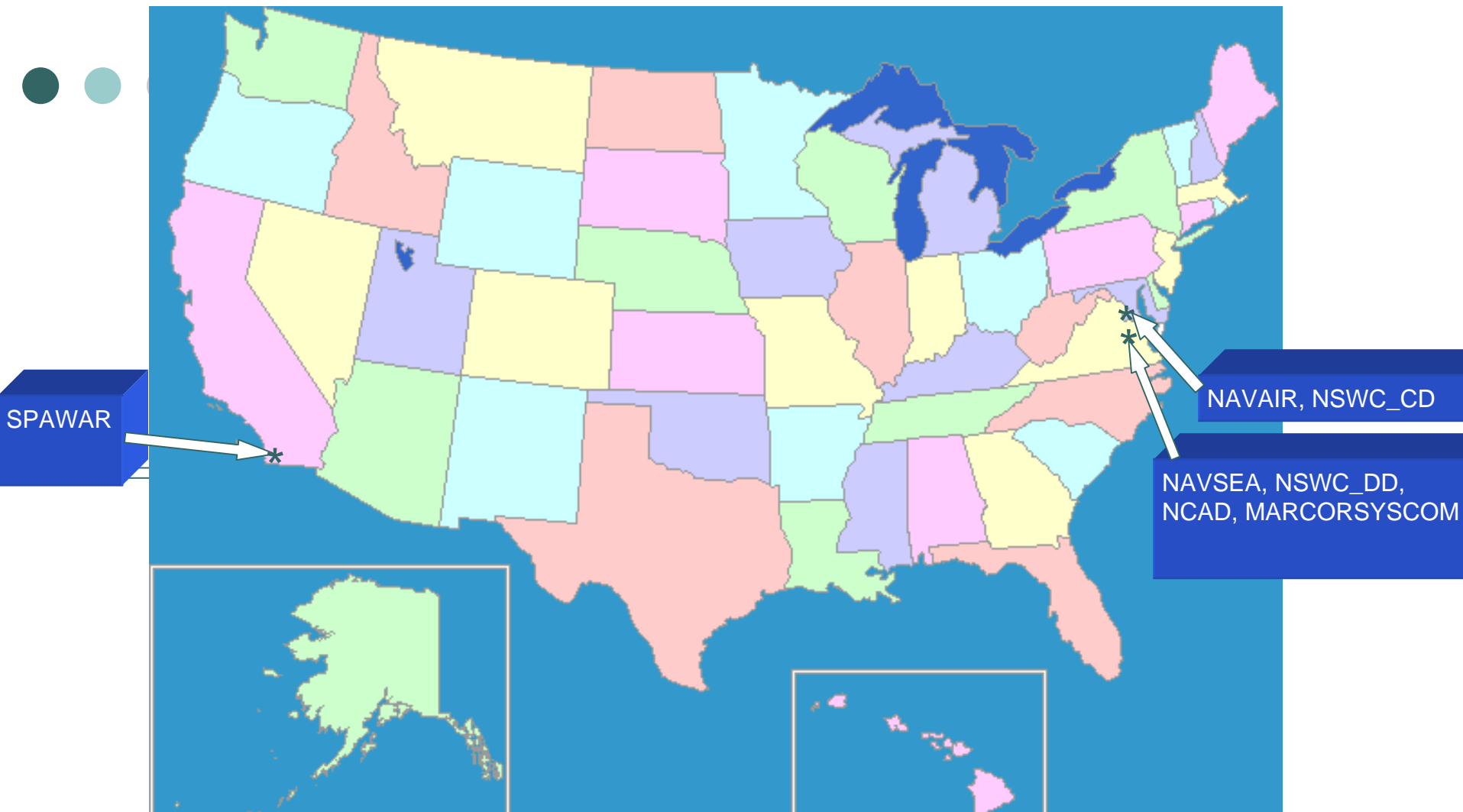
APPROACH—This is a multi-phase study





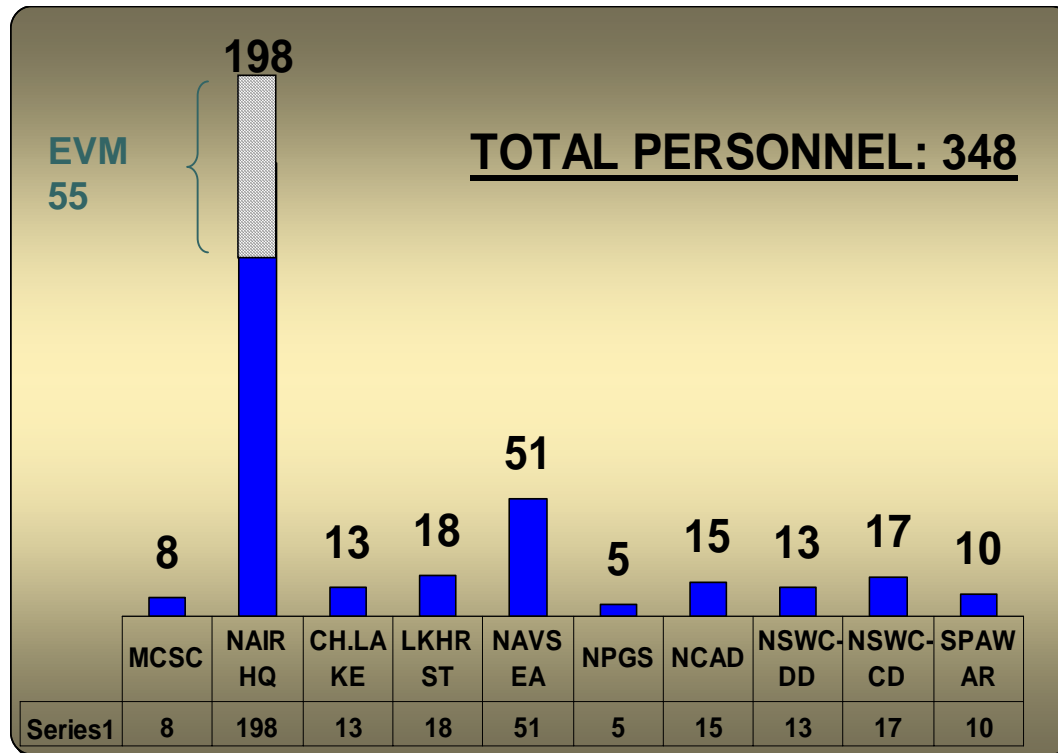
INITIAL OBSERVATIONS FROM DEPARTMENT OF NAVY EFFORT

DoN CE/A Locations



- The CE/A community is largely bi-coastal.
- China Lake and Lakehurst are included in NAVAIR's totals

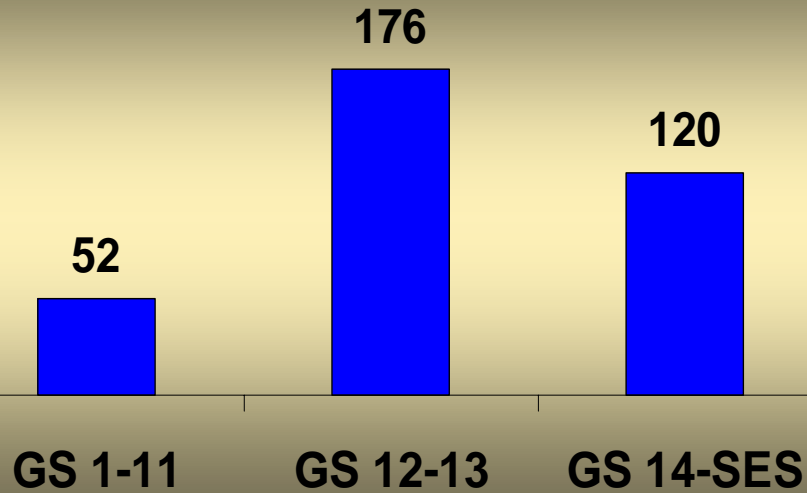
DoN Cost Estimating Personnel Totals



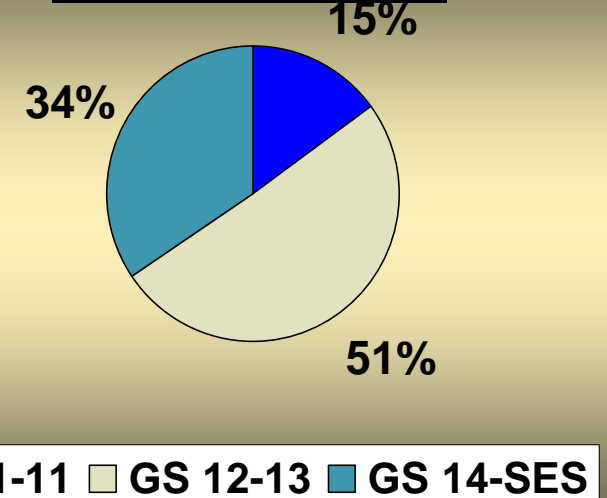
There are 348 personnel identified in the baseline assessment of the DoN CE/A community. NAVAIR HQ has 54% of the total. NAVSEA has another 15% of the total personnel, so that, together, NAVAIR and NAVSEA have 60% of the total personnel in the DoN CE/A community.

DoN Cost Estimating Personnel By Grade Levels

BY GRADE LEVELS



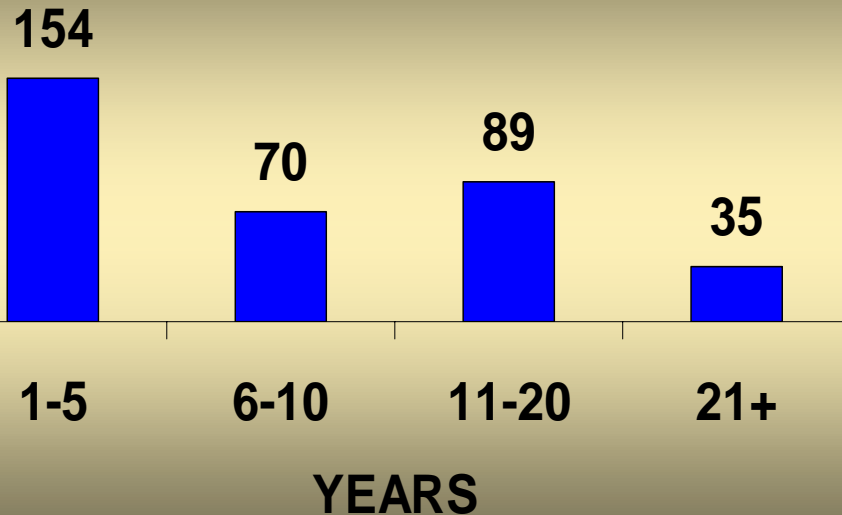
BY GRADE LEVELS



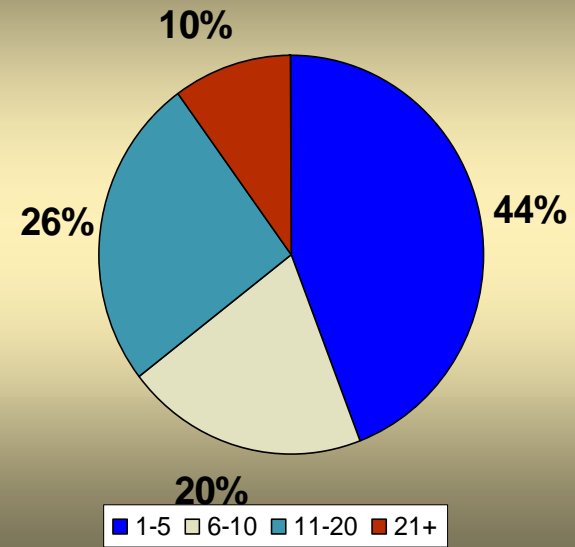
•There are more personnel in the GS 12-13 grade levels (or their equivalent levels in other pay-banding structures) than in all the other grades combined.

DoN Cost Estimating Personnel By Years of Experience

YEARS OF EXPERIENCE



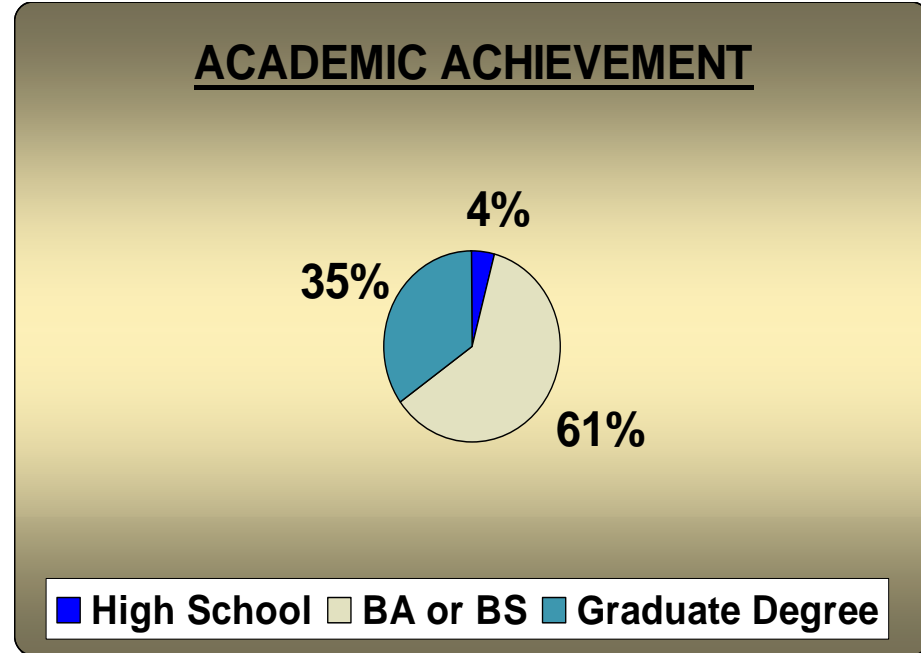
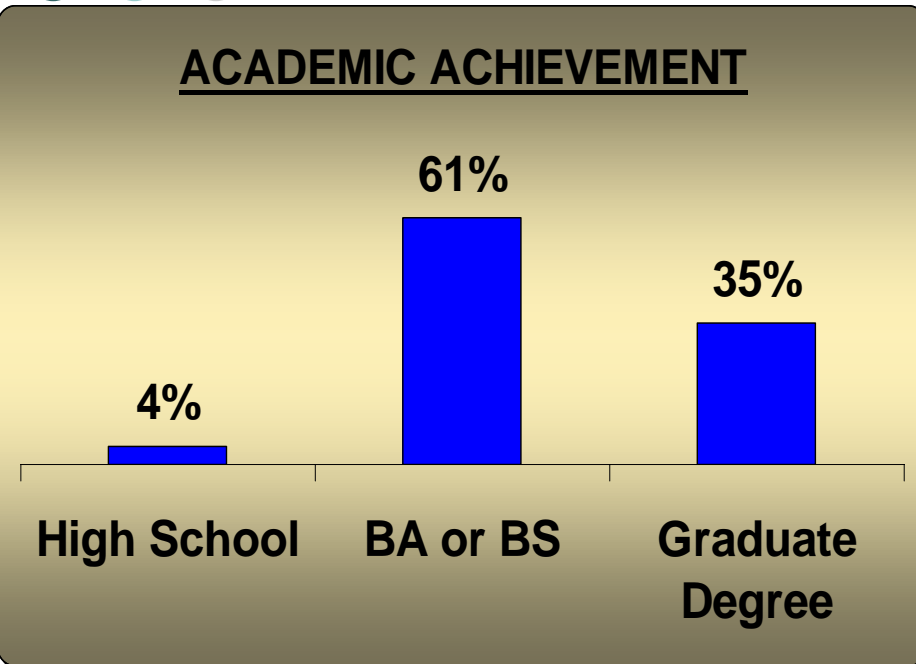
YEARS OF EXPERIENCE



• ~50% of the CE/A workforce is “young”, having only 1-5 years of experience. Mean years of experience is estimate at 10 years. Combining this observation with the Grade level information suggests that personnel reach a working grade level of GS 12-13 fairly quickly. In the 2003 SCEA National Survey (445 respondents), the mean years of experience is 18.4 years, almost twice the DoN CE/A community level.

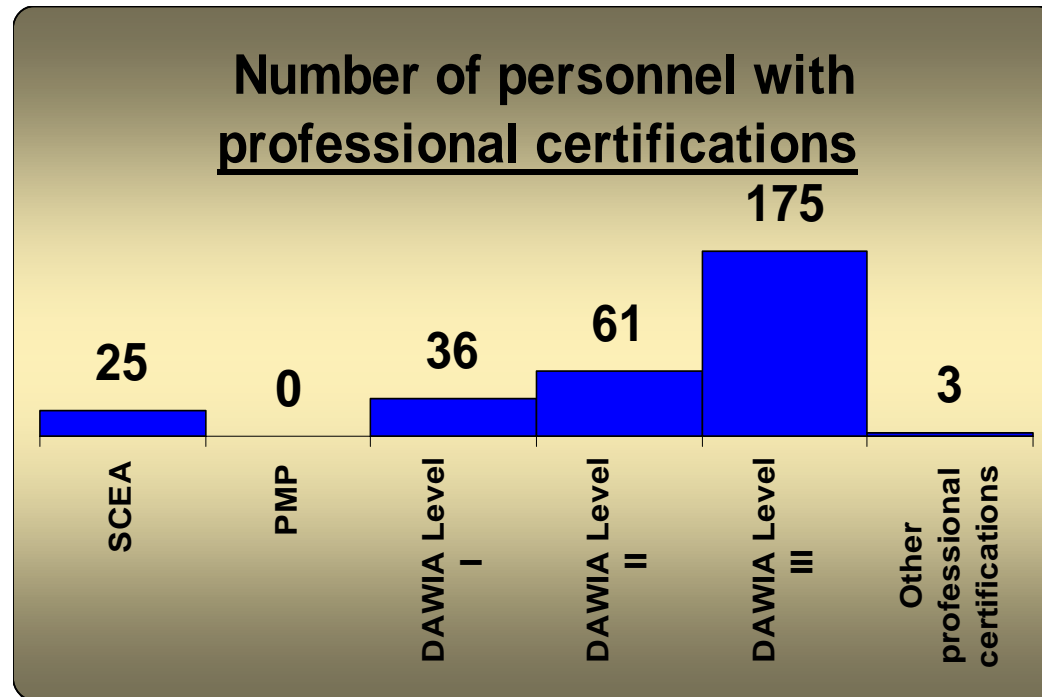
• Not shown here is that many of the current DoN CE/A leadership are graduates of the DoN CE/A Intern Program

DoN Cost Estimating Personnel By Academic Achievement



Fully one-third of the DoN CE/A community workforce has a graduate degree, while a very small 5% of the total workforce does not have at least a bachelor's degree. By comparison, almost 65% of those who responded to the 2003 SCEA National Survey have either a master's degree or a doctorate.

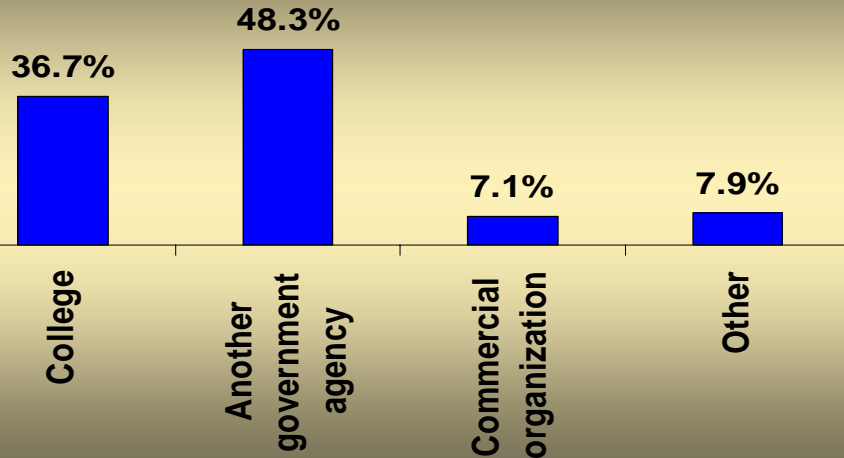
DoN Cost Estimating Personnel By Professional Certifications



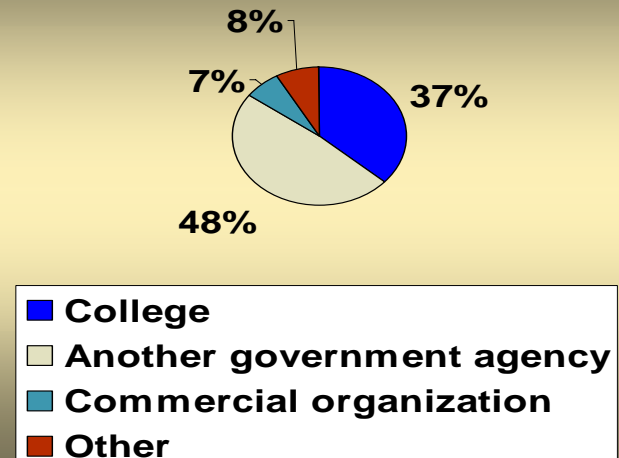
In professional certifications, the focus is fully on DAWIA and its levels of certification. Surprisingly, only 1% of the total personnel hold the Certified Cost Estimator/Analyst (CCE/A) professional certification from the Society of Cost Estimating and Analysis (SCEA). As a point of comparison, approximately one-third of SCEA's membership personnel holds the CCE/A professional certification.

DoN Cost Estimating Personnel By Prior Job Source


Personnel Source



Personnel Source

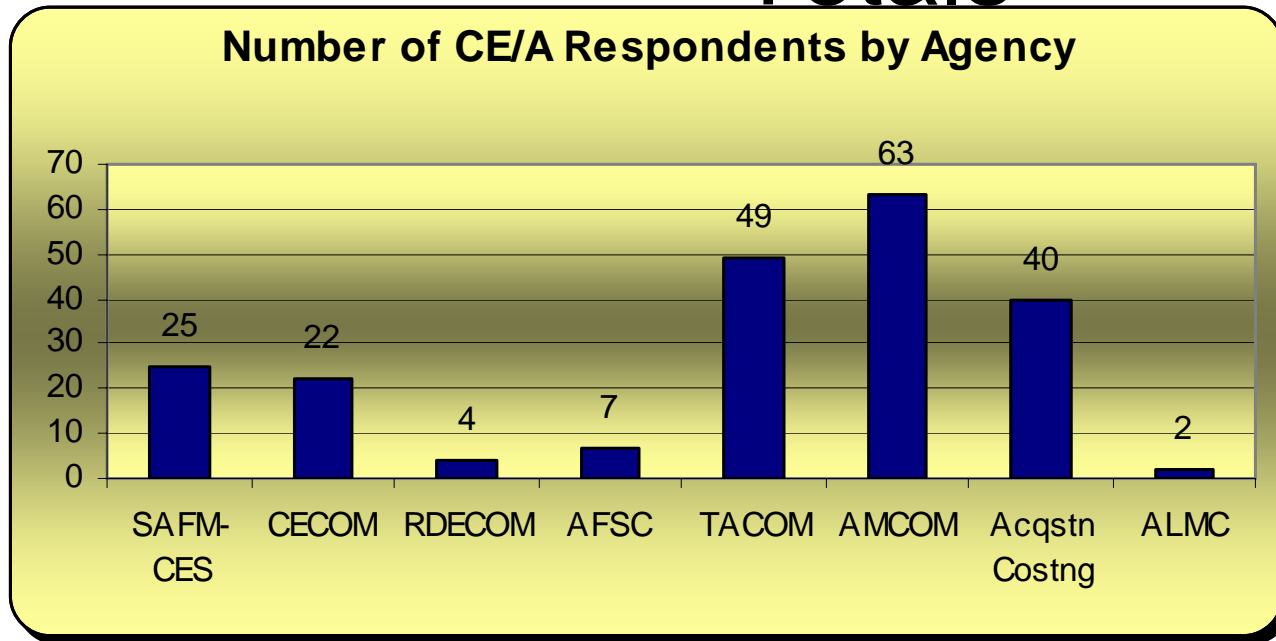


Personnel come to positions in the DoN CE/A community either directly from college or from a position in another government agency. “Out-migration” (i.e., the flow of personnel from US government positions to non-US government positions) is apparently much higher than “in-migration (i.e., the flow of personnel from a non-US government position to a US government position).



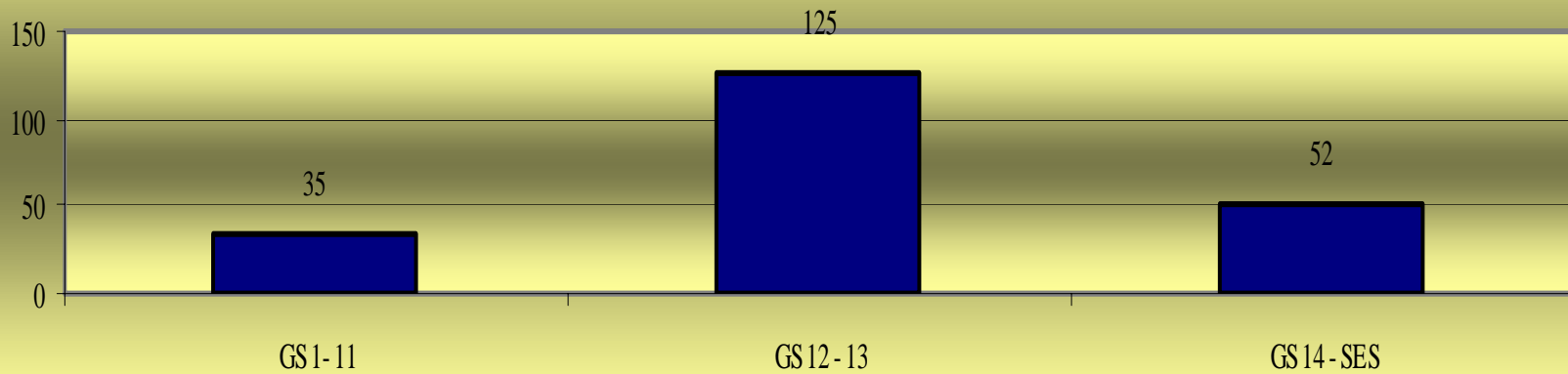
**The following data
on DA Cost
Estimating and
Analysis
Community are
incomplete.**

DA Cost Estimating Personnel Totals

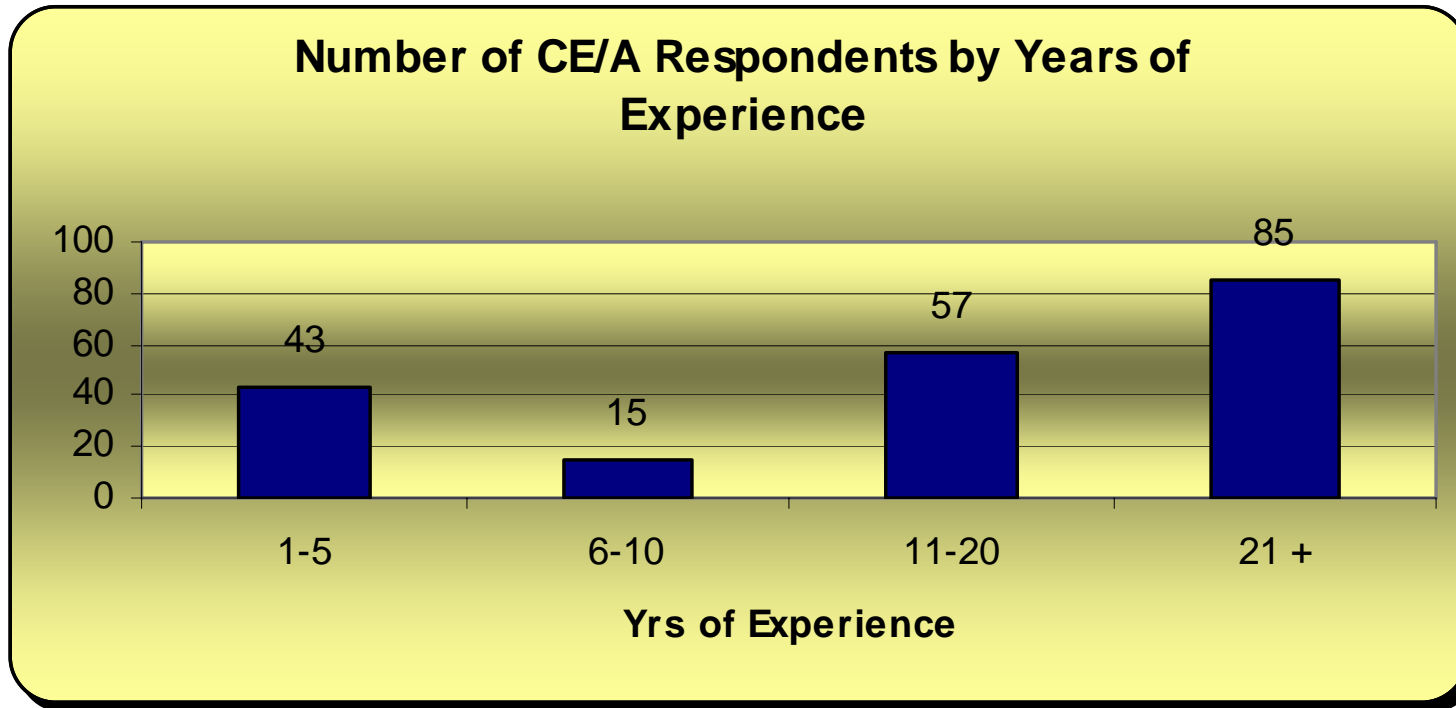


DA Cost Estimating Personnel By Grade Levels

Number of CE/ A Respondents by Grade

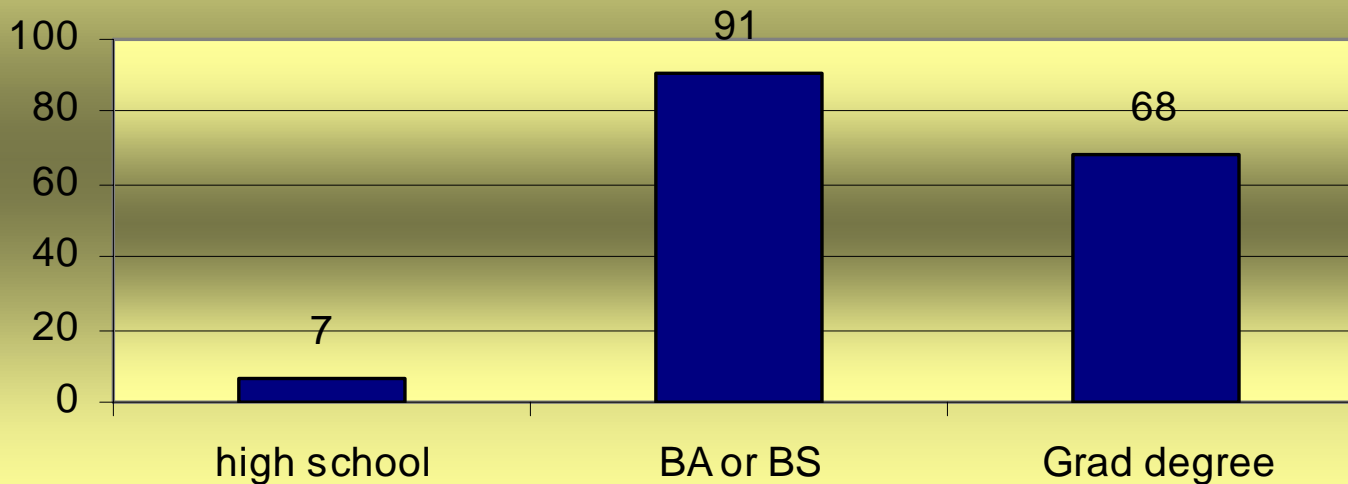


DA Cost Estimating Personnel By Years of Experience



DA Cost Estimating Personnel By Academic Achievement

Number of CE/A Respondents by Highest Academic Degree



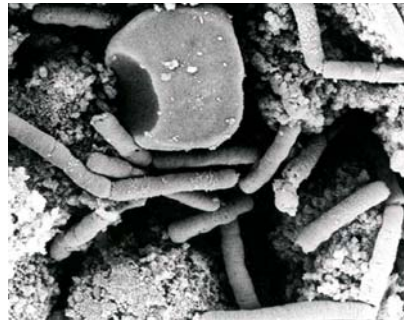
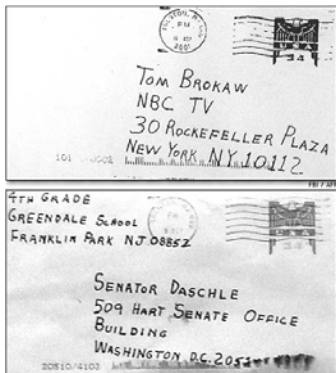
❖ Current Status

❖ Trends Circumstances which are causing an explosion in Cost Estimating Requirements across the DoD in particular, but also across the full spectrum of US Government activities.

❖ The Future

The Federal Sector Faces Major Challenges

From External Threats...





The Federal Sector Faces Major Challenges

...And From Internal Inefficiencies

"Achieving the President's vision requires effective IT management practices. The federal government is spending \$45 billion on IT in 2002, and this Budget estimates an increase to \$50 billion in 2003. But federal IT investments have

- **Poor IT Management Practices**
- **IT Investments That Lack a Valid Business Case Will Not Be Funded by OMB**

"Duplicative IT investments."

"Few IT investments have significantly improved mission performance. (*Setting departmental priorities among competing project proposals has been exception, not the rule.*)"

"Few agencies have plans demonstrating documenting the linkage between IT capital and the business needs of the agency."

"Many major IT projects do not meet cost, schedule, and performance goals."

"Major gaps exist in agency and government-wide computer-related security."

Source: Analytical Perspectives
FY2003

"While there are examples of good security in many agencies, and of a few agencies that have done very well, many

- **Significant Deficiencies in Security**
- **Requirement to Incorporate Security Into Capital Plans and BCAs**

process, OMB directed agencies to: 1) report security costs for their IT investments; 2) document in their business cases that adequate security controls have been incorporated into the life cycle planning of each IT investment; 3) reflect the agency's security priorities as reported in their corrective action plans; and 4) tie their corrective action plans for an IT investment directly to the business case for that investment.

sources: FY 2001 Report to Congress on Federal Government Information Security Reform, OMB

- **Government Is Missing the Opportunity for Significant Cost Savings by Not Opening Appropriate Activities Performed by Their Workforce to Public Private Competition.**
- **Agencies Often Do Not Have the Information Required to Determine the Full Cost of Performing a Service "In-house"**

considered for competition."

source: President's Management Agenda

Why Credible Cost Estimates are Important

- Underestimates lead to implementation disasters
 - Insufficient resources
 - Panicked decisions
 - Unrealistic expectations
 - Imprudent economics
- Overestimates lead to planning and budget disasters
 - Underutilized resources
 - Excess capacity
 - Wasteful, un-competitive pricing

Increased Risk

Provide senior decision makers an understanding of options and constraints

Prevent making and breaking of programs

- At the Service, OMB and Congressional levels, loss of credibility results in loss of program and financial flexibility, such as as Congress' legislating de facto cost caps and/or schedules in attempts to avoid future cost growth.

DoD Has a Solution for Large Programs:

Statutory and Regulatory Bases for DoD Cost Estimates

USC Title 10, Section 2432:

The SecDef shall report a full life cycle cost for each major defense acquisition program (MDAP)

USC Title 10, Section 2434:

The SecDef may not approve SDD, or the production and deployment, of a MDAP unless an independent estimate of the full life-cycle of the program ... [has] been considered by the Secretary.

... the independent estimate ... [shall] -- (a) be prepared by an office or other entity that is not under ... the military department ... directly responsible for ... [developing or acquiring] the program; and (b) include all costs without regard to funding source or management control ...

DoDI 5000.2:

... the CAIG shall prepare an independent life-cycle cost estimate and report for all milestone reviews after Milestone A (Program Initiation/Milestone B & C).

DoD Directive 5000.4:

... the OSD CAIG is chaired by the Deputy Director, Resource Analysis, in the Office of the Director, Program Analysis & Evaluation

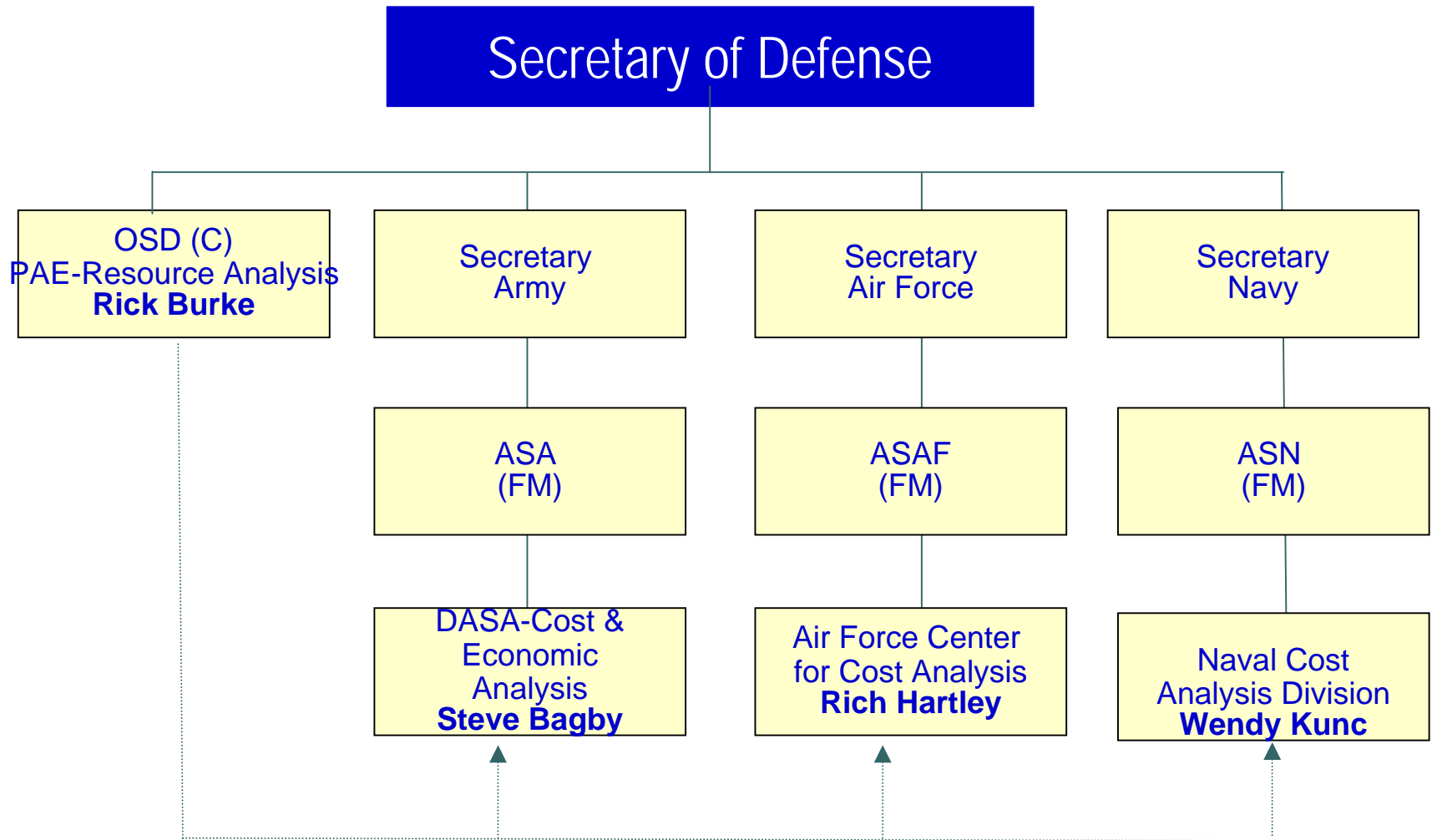
SECNAV INSTRUCTION 5420. Within the DON, the Naval Cost Analysis Division (NCAD), of the ASN(FM&C)), Office of Budget (FMB), is the designated component cost analysis group.

DoD Has a Solution for Large Programs:

The Formal Acquisition Process

	DOD 5000 ACQUISITION PROGRAM
WHAT	LCCE, includes all life cycle phases: RDT&E; Procurement; Operations and maintenance, and disposal
WHY (Statutory and policy imperatives)	<p>USC Title 10, Section 2432: The SecDef shall report a full life cycle cost for each major defense acquisition program (MDAP)</p> <p>DoDI 5000.2: The CAIG shall prepare an independent life-cycle cost estimate and report for all milestone reviews after Milestone A (Program Initiation/Milestone B & C).</p>
WHEN	Many entry point in PPBES, Acquisition Milestone Process and JCIDS
WHO	<p>Well defined functional community, with professionally grounded methodologies and guidance</p> <ul style="list-style-type: none"> ○ OSD CAIG ○ Service Cost Centers
HOW	Well defined and professionally grounded processes, methodologies and guidance.

Who Does Cost Estimating and Cost Analysis in the DoD?



COST ANALYST ENVIRONMENT

ENGINEER

- Prod. Process
- Aero Design
- Scheduling
- Materials
- Performance Parameters
- System Integration
- Production Engineering
- Test Program Development

STATISTICIAN

- Regression Analysis
- Forecasting
- Sensitivity Testing
- Learning Curve Applications
- Analysis of Commercial Models

COMPUTER SCIENTIST/ MATHEMATICIAN

- Model Development
- CER Development
- Programming
- Analysis of Proposals
- Analysis of Commercial Model

ACCOUNTANT

- Financial Analysis
- Cost Data Analysis
- Proposal Analysis
- Overhead Analysis

ECONOMIST

- Inflation-vs-Foreign
- Exchange Rates
- Labor Agreements
- Break Even Analysis
- Present Value Analysis

COST ANALYST

BUDGETING

- Program Specific
- Internal Company (Industry)
- Defense Budget Appropriations

SALESPERSON

- Sell Estimate
- Sell Approach
- Sell Self as Knowledgeable

PUBLIC AFFAIRS

- Appropriation Process
- Congressional Process//Motivations
- GAO
- General Public
- Press

Budgeting

Fee for
Service

ROI

Strategic
planning

When is Cost Analysis and Estimating Done

Acquisition

- Budget development, justification, execution
- Program development and justification
- Balance of Investment studies (force mix; investment portfolio; business portfolio, etc.)
- Selection of equipment through AoAs
- Efficient management through equipment life cycle



- All phases of life cycle.
- All processes

Types of Cost Estimates

- **Life Cycle Cost Estimate (LCCE):** Cradle to grave estimate includes R&D, production, operations/support, and disposal.
- **Independent Cost Estimate (ICE):** LCCE of most likely cost developed by an independent organization
- **Budget Estimate:** For inclusion in budget to support current activities
- **Rough-Order-of-Magnitude (ROM):** Pre design effort, with very little specific information about the project .
- **Analysis of Alternatives (AoA) :** Evaluates costs, benefits, advantages and disadvantages of different alternatives
- **Activity Based Costing (ABC):** Accounting methodology that assigns resources and overhead costs all costs to activities, products and services to support making decisions about pricing, outsourcing, capital expenditures and operational efficiency.

Know the Purpose of the Analysis before You Start It.

Explosion in Requirements to do Cost Estimating


GOVERNMENT	COMMERCIAL AND EDUCATION
<ul style="list-style-type: none">+ DoD---by statute, every major program requires an independent cost estimate (ICE)+ Intelligence Community-- by statute, every major program requires an ICE+ NASA- ISSPO overruns, failed missions, Challenger tragedy, ESMD (Mission to Mars challenge), etc.+ FAA– Next generation Air Traffic Control System; Need to professionalize cost estimating community.	<ul style="list-style-type: none">+ FAR drives requirements for Cost Estimating System+ Competitive Environment forces need to understand and control costs+ Mergers and Acquisitions force focus on enterprise-wide consistency issues+ Cost of Higher Education (Cost vs. Price)

If there's an ICE, there's going to be a PM's LCCE and a contractor's CE and a subcontractor's CE, and so on...

❖ Current Status:

❖ Trends

❖ The Future Estimation of the skillsets that will be needed by the next generation of cost estimators, and where they are likely to gain these skillsets.



❖ Estimation of the skillsets that will be needed by the next generation of cost estimators, and where they are likely to gain these skillsets.

Very few of us studied cost estimating or analysis in school

Available Training and Education Opportunities

SCHOOLHOUSE	COLLEGE AND UNIVERSITY	PROFESSIONAL ORGANIZATIONS
AFIT	UCLA	SCEA
DAU (DAWIA)	Univ. Maryland	AACE
ALMC	George Mason Univ.	ISPA
NPS	Rutgers? Cal Tech?	

Mainly for
government
personnel

Available to all



Society of Cost Estimating and Analysis (SCEA)

www.sceaonline.net

- A Non-Profit Organization dedicated to improving cost estimating and analysis in government and industry and enhancing the professional competence and achievements of its members.

Benefits to be Gained From Belonging to the Cost Estimating Professional Community

- Uniform understanding, across the Boeing enterprise, of fundamental practices, techniques, standards of professional cost estimating community.
- Understand and apply accepted models, processes and techniques, thereby achieving consistency, credibility, transparency, and reproducibility.
- Gain access to research and new professional practices, thereby enhancing the professionalism of your products.
- Enhanced standards of personal ethics and practice for those within the profession.

Selected Goals of the Society

- **Promote a common Body of Knowledge as a standard for individual excellence**
- **Foster, promote, and conduct research and educational programs**
- **Develop and maintain standards of proficiency and performance**



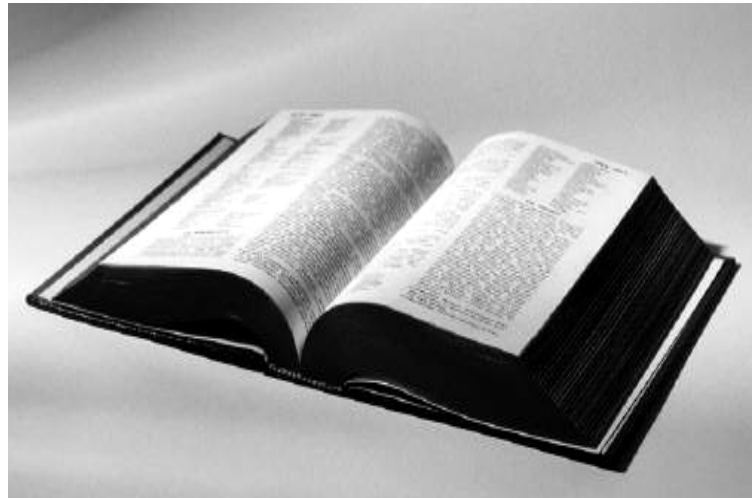
Publications

- **National Estimator**

- 2-3 Times per year
- Practical applications
- Lessons Learned

- **Journal of Cost Analysis**

- Refereed Journal
- Academic Flavor
- Changed name
- New Editors



Certification Program

Certified Cost Estimator/Analyst (CCE/A)

- Provides professional recognition to those applicants possessing the requisite education and/or job experience and successfully demonstrating their knowledge and skills through a written examination
- Valid for 5 years: re-certification based on earned points or by examination



● ● Educational Opportunities

- **National Conferences:**

Training, presentations, panel discussions

- **Regional Conferences/Symposia:**

Specific topics of interest

- **Local Chapter Programs:**

Education and training, speakers of interest

- **Training Modules/Certification Courses**

- Developing new approach
- Offer to Chapters/Regions

Cost Programmed Review of Fundamentals

Mission Statement

- **To provide world-class cost estimating training materials that will**
 - **help define the body of knowledge for cost estimating and analysis; and**
 - **prepare SCEA members thoroughly for the CCE/A exam.**
- **What else was in it for SCEA?**
 - **Chance to shape the profession**
Opportunity to make SCEA the provider of choice for cost estimating and analysis training.


16 Training Modules

- **Cost Estimating**
 - 1: Cost Estimating Basics
 - 2: Costing Techniques
 - 3: Parametric Estimating
- **Cost Analysis Techniques**
 - 4: Data Collection/Normalization
 - 5: Index Numbers/Inflation
- **Analytical Methods**
 - 6: Basic Data Analysis Principles
 - 7: Learning Curve
 - 8: Regression Analysis
 - 9: Cost Risk Analysis
 - 10: Probability and Statistics
- **Specialized Costing**
 - 11: Manufacturing Cost Estimating
 - 12: Software Cost Estimating
- **Management Applications**
 - 13: Economic Analysis
 - 14: Contract Pricing
 - 15: Earned Value Management Systems (EVMS)
 - 16: Cost Management



○ BACKUP SLIDES

Cost Estimating Process

- 
- Work Breakdown Structure (WBS) Development
 - Program/System Baseline Development
 - Data Collection and Analysis
 - Cost Element Methodology
 - Estimate Development and Validation
 - Results and Report Generation

Cost Estimating- What?

- Cost Estimating:
 - The process of collecting and analyzing historical data and applying quantitative models, techniques, tools, and databases to predict the future cost of an item, product, program or task.
 - The art of approximating the probable worth (or cost) of something based on information available at the time.
 - The act of developing, analyzing, and documenting cost estimates using analytical approaches and techniques
- Purpose of cost estimating
 - Translate system/functional requirements associated with programs, projects, or processes into budget requirements
 - Determine and communicate a realistic view of the likely cost outcome, which can form the basis of the plan for executing the work

How is Cost Estimating Done?

Three essential Costing Techniques

- **Analogy:** “It’s like one of these” subjectively compares the new system with one or more existing similar systems for which there is accurate cost and technical data.
- **Parametric:** “This pattern holds” sometimes known as the statistical method, this technique generates an estimate based on system performance or design characteristics. It uses a database of elements from similar systems. It differs from analogy in that it uses multiple systems and makes statistical inferences about the cost estimating relationships.
- **Build-Up:** “It’s made up of these” “bottom-up” method of cost analysis that is the most detailed of all the techniques and the most costly to implement. Each WBS element must be costed to build the cost estimate for the entire program.
- **Expert Opinion:** “The other methods are not available”

❖ Costing Techniques rely on statistical properties, logical relationships, emotional appeal.

❖ They are based on historical data

❖ Techniques are generally aligned with life cycle phases

Where statistical cost estimating methods are currently used

❖ Industry and finance

- Quality control
- Monitoring of sales
- Economic forecasting
- HR monitoring
- Investment analysis
- Portfolio Theory
- Accounting
- Auditing

❖ Engineering

- Fault and failure monitoring
- Process evaluation
- Yield optimization

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***The statistical method is more than an array of techniques. The statistical method is a Mode of Thought; it is Sharpened Thinking; it is Power.”
(WE Deming, 1953)***